

COST CONTAINMENT THROUGH ENERGY EFFICIENCY IN TEXAS STATE-OWNED BUILDINGS

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ABSTRACT

"The Energy Cost Containment Through Energy Efficiency" in Texas State-owned buildings project was begun in the spring of 1984 as a part of a multi-pronged effort to reduce rising energy costs in State operations. Energy audits of 21 million square feet (22% of total conditioned space) were conducted by three energy engineering firms and Texas Engineering Extension Service personnel under contract to the Public Utility Commission of Texas. Retrofits totalling \$15.6 million with annual savings of \$9.2 million were identified (59% ROI). This paper will detail the objectives of the project, summarize audit results, and outline financing options for individual projects.

BACKGROUND

Electricity and natural gas utility expenditures in state-owned buildings in Texas escalated from \$42 million in 1974 to over \$207 million in 1984 for an average annual increase of nineteen percent. The price of natural gas rose by 1500 percent from \$0.31 per MCF in 1974 to \$5.00 per MCF in 1984. During the same ten year period, electricity prices rose from \$0.02 KWH to \$0.08 KWH. In the past four years, utility expenditures have more than doubled as a result of escalating fuel prices and the addition of less than efficient state-owned building space.

Texas state agencies occupy buildings with a gross area in excess of 138.5 million square feet. The usage of these buildings varies from very energy intensive operations in state hospitals to very low energy usage in storage facilities. Consumption varies from a high of 512,000 BTUs per sq. ft. to a low of 96,000 BTUs per sq. ft. according to a 1984 survey of state-owned buildings.(1) Few, if any, incentives exist for building operators to conserve energy and reduce utility expenditures, according to a 1984 Texas A&M study.(2) Capital requests by agencies for efficiency improvements compared to classroom space have had a very low priority with past legislatures.

INTRODUCTION

Faced with ever increasing utility expenditures and a potential budget deficit of one billion dollars, Governor Mark White initiated a comprehensive Energy Cost Containment Program in November, 1983, designed to reduce significantly energy consumption in state buildings. Three major components of the program were:

- o Policy Study -- The Governor's Office and the Public Utility Commission of Texas ordered a study by Texas A&M University of various policy options available to the state for reducing utility expenditures.
- o Staff Training -- State agency energy managers, legislative budget personnel and physical plant operators attended energy management training sessions.
- o Engineering Audits -- The Public Utility Commission provided engineering audits to state agencies on a request basis.

This comprehensive energy management program was the first major attempt since 1974 to reduce agency energy consumption statewide. It was a very bold undertaking because of the number of buildings to be audited and the limited six month time frame available to complete the audits prior to the legislative session in January, 1985. The audit program was also unique in that a successful financing plan was found for 75 percent of the recommended retrofits.

PROJECT DESCRIPTION

In late 1933, Governor Mark White initiated an aggressive program to curb spiraling utility bills using budget personnel and building facilities management. The Governor's first action was to direct all agencies to appoint an energy contact and establish energy consumption reduction goals for the remainder of the state's fiscal year. Agencies were required to submit consumption data to the PUCT for the past four years and to report progress semi-annually on their energy goals to his budget analysts.

Policy Options and Agency Training. The PUCT and the Governor's budget office directed Texas A&M to complete a detailed investigation into the state's options for efficiency in existing, state-owned buildings; in new construction design; by the use of state in-kind natural gas; and by the co-generation of electricity. State agency energy

contacts, budget managers, and facilities managers representing over 70 state agencies attended two-day energy management training sessions conducted by the Texas Engineering Extension Service in fourteen different locations. Over 400 state employees participated in the training.

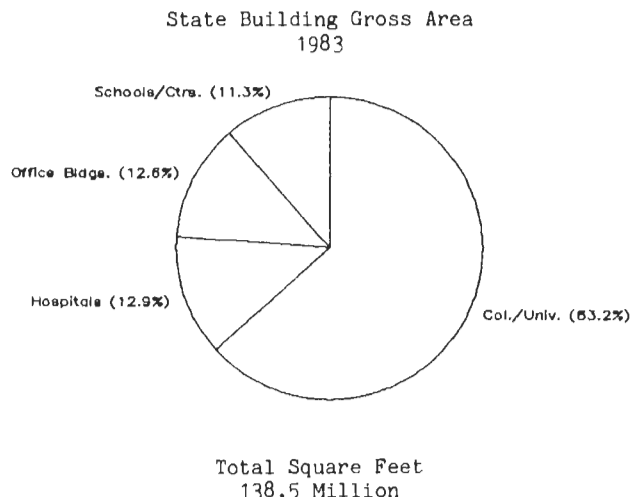
ENGINEERING AUDITS

The PUCT, using oil overcharge funds returned to the state, provided energy audits to over 70 state agencies on a request basis. Streamlined audits similar to those used in the Federal Institutional Conservation Program were conducted by three engineering firms and Texas Engineering Extension Service personnel. The lead engineering firm developed audit guidelines designed to identify the best cost reduction opportunities with paybacks of four years or less.

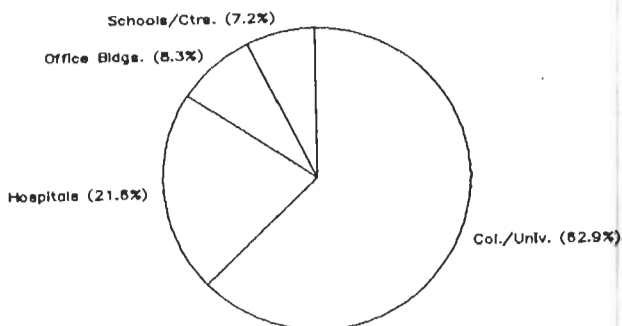
Maintenance and operations and capital retrofits were included in audit reports on each agency surveyed. All energy cost improvement projects with paybacks less than one year were forwarded to the Governor's office for immediate implementation consideration by individual agencies and their budget examiners.

Seventy-three state facilities representing 22 percent of the state's 138.5 million square feet of building space requested engineering audits. Audits in almost 21 million square feet of state hospitals, schools, health centers, and office buildings resulted in 550 specific recommendations for reducing energy costs.

To provide more meaningful comparisons among buildings audited, they were divided into four categories: (1) office buildings, (2) state schools and health centers, (3) state hospitals, and (4) universities. The following pie chart illustrates the audited state space by agency type:



Audit State Space
By Agency Type



Total Square Feet
20.8 Million

Audit Results. The engineering audits uncovered a wide range of consumption within the four building categories. The Energy Cost Index (ECI) and the Energy Use Index (EUI) were used to compare cost and consumption. The following table describes the wide range of usage and energy costs found in the statewide audit program:

Building Type	EUI RANGE (Btu's/SF/Yr)	ECI RANGE (\$/SF/Yr)
Hospitals	173,365 - 512,860	1.40 - 5.71
Universities	64,636 - 473,210	.84 - 4.37
State Schools/ Centers	60,906 - 237,589	1.14 - 2.75
State Office Buildings	91,003 - 250,218	1.05 - 2.57

Few state office buildings were found to be well constructed or operated efficiently. A summary report by the engineering project manager found that "most buildings offered ample opportunity for significant savings." Some of the newer state buildings were found to be even less efficient than those built prior to 1978.

Annual cost savings totaling \$9.2 million were identified. Total implementation costs for all 550 recommendations were estimated to be \$15.6 million with a simple payback of 1.7 years and a ROI of 59 percent. A complete list of recommended projects is contained in Appendix A.

The Cost Containment Audit Program revealed several major findings having significant potential on state utility expenditures. Findings from the technical audit and from interviews with agency energy managers and staff were grouped into three categories: (1) technical, (2) policy, and (3) funding.

Technical Recommendations. The technical recommendations were:

- o Projects with less than a one year payback should be implemented immediately by the agency

out of existing funds.

- o Metering equipment should be installed in all major buildings prior to project installation to assist in determining project impact.

Policy Recommendations. Policy recommendations were as follows:

- o The State should develop a cohesive, continuing, and comprehensive energy policy regarding energy use in its own buildings.
- o The State should authorize a single agency to monitor agency utility consumption along with uniform reporting guidelines.
- o Stringent, cost-effective standards for new and retrofit construction should be developed and enforced.
- o New purchasing requirements for energy efficient equipment should be developed.
- o Agencies should provide on-going training for energy managers and facilities personnel.
- o Agency utility budget practices should be changed to provide incentives for saving.
- o State agencies should continue to audit state-owned space.

Most of these recommendations were also made in the earlier policy report by Texas A&M on state agency energy consumption and were again affirmed by the engineers conducting the audits.(2)

Retrofit Funding. Significant dollar savings are available to the state as a result of the audits conducted in this program. A 50 percent return-on-investment is available on the combined projects identified. Major funding recommendations were:

- o The legislature should fund the capital investment projects with less than 4-year paybacks.
- o In the absence of state funding, alternative financing such as revenue bonds, equipment leases, or third party financing should be secured by the individual agencies.

PROGRAM CONCLUSION

Revenue Bonds. Recent state legislation provided full funding through the issuance of state revenue bonds for the majority of the projects. Senate S.B. 1435, in May 1985, was amended by Representative R. Williamson authorizing the Texas Public Building Authority to provide \$11.8 million in revenue bond financing for 33 of the facilities audited. The estimated energy savings to the state is \$6 million per year, yielding a simple payback of approximately two years. Most of the projects include efficient lighting retrofits, HVAC modifications, and automated energy management systems. Since this is the first time Texas has used this innovative funding mechanism for energy efficiency improvements, success with these

projects should serve as an added incentive for continued funding of similar retrofits in the future. Project implementation will begin in September 1985, with bond repayment from saved utility costs.

Agency Incentives. The 69th Texas Legislature provided two significant incentives for agencies to conserve. First, a stick in the form of freezing utility expenditures at the FY 84-85 levels for the coming biennium was necessary in order to balance the state's recent Appropriations Act. Second, state institutions of higher education will for the first time be allowed to retain documented utility savings for reinvestment in additional energy efficiency investments. The ultimate success of these efforts during the coming state fiscal period will be of extreme interest to legislators, budget examiners, agency energy managers, and the state's taxpayers.

REFERENCES

- (1) "Cost Containment Through Energy Efficiency: A Summary Report" by ACR Energy Engineering, Inc.; Austin, Texas; May, 1985.
- (2) "Reducing Energy Costs in the Texas State Agencies: Conservation and Policy Options" by W. Turner, D. O'Neal, W. Murphy and S. Subramaniam; Energy Systems Laboratory, Texas A&M University; August, 1984.

Attachment A

COST CONTAINMENT THROUGH ENERGY EFFICIENCY
FINANCIAL SUMMARY
LISTING BY AGENCY NUMBER

AGENCY NO.	AGENCY NAME	M&O \$ SAVINGS	M&O COST	CAPITAL INVESTMENT \$ SAVINGS	CAPITAL INVESTMENT COST	CAPITAL INVESTMENT PAYBACK	CAPITAL INVESTMENT ROI	TOTAL \$ SAVINGS	TOTAL \$ COST	COMBINED PAYBACK (YEARS)	TWO ** YEAR SAVINGS	FIVE ** YEAR SAVINGS	TEN ** YEAR SAVINGS
304	COMPT OF PUBLIC ACCTS	2,277		3,754	11,296	3.0	33%	6,031	11,296	1.9	12,303	32,664	72,408
322	TEXAS EMPLOYMENT COMMISSION	7,178		299,674	270,663	0.9	111%	306,852	270,663	0.9	625,978	1,661,910	3,684,065
323	TEACHER RETIREMENT SYSTEM	1,638		69,406	255,477	3.7	27%	71,044	255,477	3.6	144,930	384,774	852,954
327	EMPLOYEES RETIREMENT SYSTEM	33,580		25,215	42,765	1.7	59%	58,795	42,765	0.7	119,942	318,434	705,893
* 405	DEPT OF PUBLIC SAFETY-AUSTIN												
405	DPS, HOUSTON	4,321		18,797	47,424	2.5	40%	23,118	47,424	2.1	47,161	125,207	277,555
405	DPS, CORPUS CHRISTI			3,853	4,400	1.1	88%	3,853	4,400	1.1	7,860	20,868	46,259
405	DPS, WACO			2,272	3,050	1.3	74%	2,272	3,050	1.3	4,635	12,305	27,278
405	DPS, LUBBOCK			2,738	3,130	1.1	87%	2,738	3,130	1.1	5,586	14,829	32,872
501	TEXAS DEPT OF HEALTH			203,262	530,100	2.6	38%	203,262	530,100	2.6	414,654	1,100,867	2,440,364
* 654	BROWNWOOD STATE SCHOOL												
655	DEPT OF MENTAL HEALTH AND MR	515		106,662	281,523	2.7	38%	107,177	281,523	2.6	218,641	580,471	1,286,767
656	VERNON STATE HOSPITAL			2,847	1,255	0.4	227%	2,847	1,255	0.4	5,808	15,419	34,181
* 657	AMARILLO STATE CENTER												
658	BEAUMONT STATE CENTER	2,921	3,257	17,007	22,615	1.3	75%	19,928	25,872	1.3	40,653	107,930	239,256
659	RIO GRANDE STATE CENTER			37,100	114,820	3.1	32%	37,100	114,820	3.1	75,684	200,934	445,423
660	DENTON STATE SCHOOL	3,415		148,912	360,140	2.4	41%	152,327	360,140	2.4	310,747	825,003	1,828,838
661	EL PASO STATE CENTER	2,914		18,237	50,516	2.8	36%	21,151	53,449	2.5	43,148	114,554	253,939
670	CORPUS CHRISTI STATE SCHOOL			115,272	420,000	3.6	27%	115,272	420,000	3.6	235,155	624,313	1,383,956
671	SAN ANGELO STATE SCHOOL	3,091		210,465	547,702	2.6	38%	213,556	547,702	2.6	435,654	1,156,619	2,563,953
673	SAN ANTONIO STATE CHEST HOSP	1,290		82,828	96,265	1.2	86%	84,118	96,265	1.1	171,601	455,583	1,009,921
674	KERRVILLE STATE HOSPITAL	72		14,206	37,600	2.6	38%	14,278	37,600	2.6	29,127	77,330	171,422

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675	TRAVIS STATE SCHOOL	2,502		54,696	166,106	3.0	33%	57,198	166,106	2.9	116,684	309,784	686,719
677	AUSTIN STATE HOSPITAL	3,169	2,694	545,864	438,272	0.8	125%	549,033	440,966	0.8	1,120,027	2,973,563	6,591,690
678	AUSTIN STATE SCHOOL	36,339		143,866	236,883	1.6	61%	180,205	236,883	1.3	367,618	975,990	2,163,541
* 680 WACO CENTER FOR YOUTH													
681	SAN ANTONIO STATE HOSPITAL	10,470		21,899	67,644	3.1	32%	32,369	67,644	2.1	66,033	175,311	388,622
682	TERRELL STATE HOSPITAL			305,177	530,199	1.7	58%	305,177	530,199	1.7	622,561	1,652,839	3,663,955
683	WICHITA FALLS STATE HOSPITAL			30,938	97,541	3.2	32%	30,938	97,541	3.2	63,114	167,560	371,442
685	TX RESEARCH INST MENTAL SCI			74,283	312,861	4.2	24%	74,283	312,861	4.2	151,537	402,317	891,842
687	LUBBOCK STATE SCHOOL	2,559		14,039	11,218	0.8	125%	16,598	11,218	0.7	33,860	89,895	199,276
688	BRENNHAM STATE SCHOOL			39,714	82,545	2.1	48%	39,714	82,545	2.1	81,017	215,091	476,806
689	GIDDINGS STATE SCHOOL			14,745	20,145	1.4	73%	14,745	20,145	1.4	30,080	79,859	177,028
690	WEST TEXAS CHILDRENS HOME	258	48	15,907	39,998	2.5	40%	16,165	40,046	2.5	32,977	87,550	194,077
692	GAINESVILLE STATE SCHOOL	1,384	1,741	16,309	44,522	2.7	37%	17,693	46,263	2.6	36,094	95,825	212,422
693	CROCKETT STATE SCHOOL	1,803		6,716	1,882	0.3	357%	8,519	1,882	0.2	17,379	46,139	102,279
696	DEPT CORRECTIONS-HUNTSVILLE	12,150		123,473	112,800	0.9	109%	135,623	112,800	0.8	276,671	734,534	1,628,290
696	TDC, BETO II, PALESTINE	931		4,538	350	0.1	1297%	5,469	350	0.1	11,157	29,620	65,661
696	TDC COFFIELD(MEAT PLANT)PALES	42,255		1,008	890	0.9	113%	43,263	890	.0	88,257	234,312	519,416
696	TDC, GATESVILLE			2,334	7,350	3.1	32%	2,334	7,350	3.1	4,761	12,641	28,022
697	BOARD OF PARDONS AND PAROLES	462		2,290	3,900	1.7	59%	2,752	3,900	1.4	5,614	14,905	33,041
713	TARLETON STATE UNIVERSITY	12,136	8,000	78,051	123,988	1.6	63%	90,187	131,988	1.5	183,981	488,453	1,082,785
715	PRAIRIE VIEW A&M UNIVERSITY	8,832		389,831	901,860	2.3	43%	398,663	901,860	2.3	813,273	2,159,159	4,786,348
717	TEXAS SOUTHERN UNIVERSITY	86,432		506,668	1,223,129	2.4	41%	593,100	1,223,129	2.1	1,209,924	3,212,230	7,120,759
718	TX A&M UNIV AT GALVESTON	6,531		92,093	113,685	1.2	81%	98,624	113,685	1.2	201,193	534,148	1,184,080
719-1	TEXAS STATE TECH INST-WACO	17,017	6,892	58,931	119,724	2.0	49%	75,948	126,616	1.7	154,934	411,334	911,832
719-2	TEX ST TECH INST-HARLINGEN	1,300		46,039	151,211	3.3	30%	47,339	151,211	3.2	96,572	256,388	568,352
719-3	TEX ST TECH INST-AMAR	3,595		60,058	91,730	1.5	65%	63,653	91,730	1.4	129,852	344,745	764,218
721	UNIV OF TEXAS AT AUSTIN	58,298	9,469	421,200	206,180	0.5	204%	479,498	215,649	0.4	978,176	2,596,961	5,756,853
730	UNIV OF HOUSTON-UNIV PARK	445,360	852	730,449	1,775,057	2.4	41%	1,175,809	1,775,909	1.5	2,398,650	6,368,182	14,116,763
731	TEXAS WOMAN'S UNIVERSITY	9,754		339,370	395,045	1.2	86%	349,124	395,045	1.1	712,213	1,890,856	4,191,583
732	TEXAS A&I UNIVERSITY	10,500		316,741	577,700	1.8	55%	327,241	577,700	1.8	667,572	1,772,337	3,928,855
733	TEXAS TECH UNIVERSITY			328,482	479,014	1.5	69%	328,482	479,014	1.5	670,103	1,779,059	3,943,755
734	LAMAR UNIVERSITY	51,300	53,597	124,345	231,172	1.9	54%	175,645	284,769	1.6	358,316	951,293	2,108,794
735	MIDWESTERN UNIVERSITY	11,682	37,208	179,841	479,000	2.7	38%	191,523	516,208	2.7	390,707	1,037,289	2,299,425
737	SAN ANGELO STATE UNIV			19,950	65,590	3.3	30%	19,950	65,590	3.3	40,698	108,049	239,520

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AGENCY NO.	AGENCY NAME	M&O \$ SAVINGS	M&O COST	CAPITAL INVESTMENT \$ SAVINGS	CAPITAL INVESTMENT COST	CAPITAL INVESTMENT PAYBACK	CAPITAL INVESTMENT ROI	TOTAL \$ SAVINGS	TOTAL \$ COST	COMBINED PAYBACK (YEARS)	TWO ** YEAR SAVINGS	FIVE ** YEAR SAVINGS	TEN ** YEAR SAVINGS
739	TX TECH HEALTH SCI CNTR-AMAR	632		13,916	19,529	1.3	71%	14,548	19,529	1.3	29,678	78,792	174,663
739	TTHSC, LUBBOCK			348,478	666,374	1.9	52%	348,478	666,374	1.9	710,895	1,887,357	4,183,827
739	TTHSC, EL PASO			52,123	73,315	1.4	71%	52,123	73,315	1.4	106,331	282,298	625,789
751	EAST TEXAS STATE UNIV	4,597		330,226	419,871	1.3	79%	334,823	419,871	1.3	683,039	1,813,401	4,019,885
752	NORTH TEXAS STATE UNIV	5,117		155,192	398,943	2.6	39%	160,309	398,943	2.5	327,030	868,234	1,924,670
753	SAM HOUSTON STATE UNIV	2,631		16,187	36,973	2.3	44%	18,818	36,973	2.0	38,389	101,918	225,929
754	SOUTHWEST TEXAS STATE UNIV	459		65,603	179,616	2.7	37%	66,062	179,616	2.7	134,766	357,792	793,140
755	STEPHEN F AUSTIN STATE UNIV	2,738		159,573	295,852	1.9	54%	162,311	295,852	1.8	331,114	879,076	1,948,706
759	UNIV HOUSTON-CLEAR LAKE CITY			363,456	566,465	1.6	64%	363,456	566,465	1.6	741,450	1,968,478	4,363,653
760	CORPUS CHRISTI STATE UNIV	11,309	3,200	85,374	180,150	2.1	47%	96,683	183,350	1.9	197,233	523,635	1,160,776
761	LAREDO STATE UNIVERSITY	252		1,020	1,018	1.0	100%	1,272	1,018	0.8	2,595	6,889	15,272
764	EAST TX STATE UNIV-TEXARKANA	2,614						2,614			5,333	14,157	31,384
* 771	SCHOOL FOR THE BLIND												
772	SCHOOL FOR THE DEAF	2,600		8,945	5,564	0.6	161%	11,545	5,564	0.5	23,552	62,528	138,609
784	UNIV OF HOUSTON-DOWNTOWN	18,152	150	170,967	312,959	1.8	55%	189,119	313,109	1.7	385,803	1,024,269	2,270,563
802	PARKS & WILDLIFE DEPARTMENT	2,050		29,696	90,130	3.0	33%	31,746	90,130	2.8	64,762	171,936	381,142
808	TEXAS HISTORICAL COMMISSION			7,161	10,640	1.3	67%	7,161	10,640	1.5	14,608	38,784	85,975
TOTALS		953,382	127,108	8,300,269	15,467,331	1.9	54%	9,253,651	15,594,439	1.7	18,877,448	50,117,774	111,099,334
EXTRAPOLATION TO REMAINING													
78%	OF STATE SQUARE FOOTAGE	4,333,555	577,764	37,728,495	70,306,050	1.9	54%	42,062,050	70,883,814	1.7	85,806,582	227,808,063	504,996,972
PROJECTED TOTAL SAVINGS FOR ALL STATE AGENCIES		5,286,937	704,872	46,028,764	85,773,381	1.9	54%	51,315,701	86,478,253	1.7	104,684,030	277,925,837	616,096,306

* On-site surveys at these agencies did not identify any conservation opportunities having a payback of less than four years.

**All projected savings after the first year assume a 4% per year escalation factor for utilities.